

## CLAIMS

1. A photosensitive resin composition, comprising a base resin component (A) and a (meth)acryls compound (B) as essential components, wherein

the base resin component (A) is any one of: a polyimide resin (A-1) having at least either a hydroxyl group or a carboxyl group in its structure; a polyamide resin (A-2) having at least either a hydroxyl group or a carboxyl group in its structure; and photosensitive imide (meth)acrylsiloxaneoligomer (A-3).

2. The photosensitive resin composition as set forth in claim 1, wherein:

the base resin component is the polyimide resin (A-1) or the polyamide resin (A-2), and

the (meth)acryls compound (B) is at least one kind of a compound selected from a (meth)acrylic compound, an epoxy (meth)acrylate, a polyester (meth)acrylate, a urethane (meth)acrylate, and an imide (meth)acrylate.

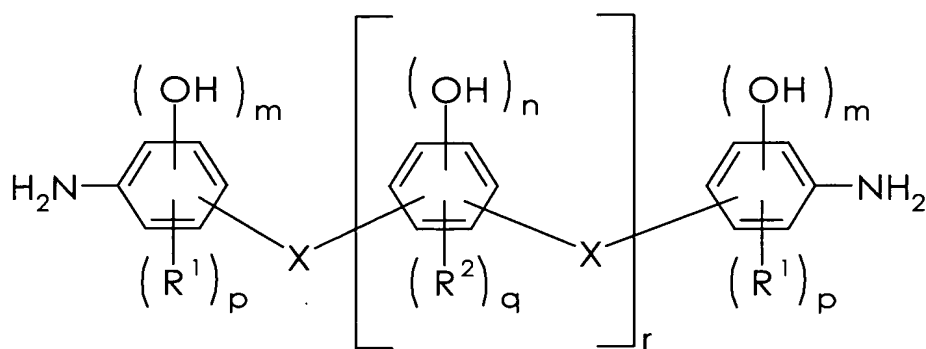
3. The photosensitive resin composition as set forth in claim 2, wherein:

the polyimide resin (A-1) is a polyimide resin having a phenolic hydroxy group (A-1-1) which is a polyimide resin

partially made of a phenol derivative having an amino group,  
and

the phenol derivative is such that two or more phenol  
compounds bind each other via an atom or an atom group in a  
chain manner and each of the phenol compounds at both ends  
has an amino group which substitutes one of hydrogen atoms  
in a benzene ring.

4. The photosensitive resin composition as set forth in  
claim 3, wherein the phenol derivative used as a martial for  
the polyimide resin (A-1-1) is a compound represented by  
formula (1)

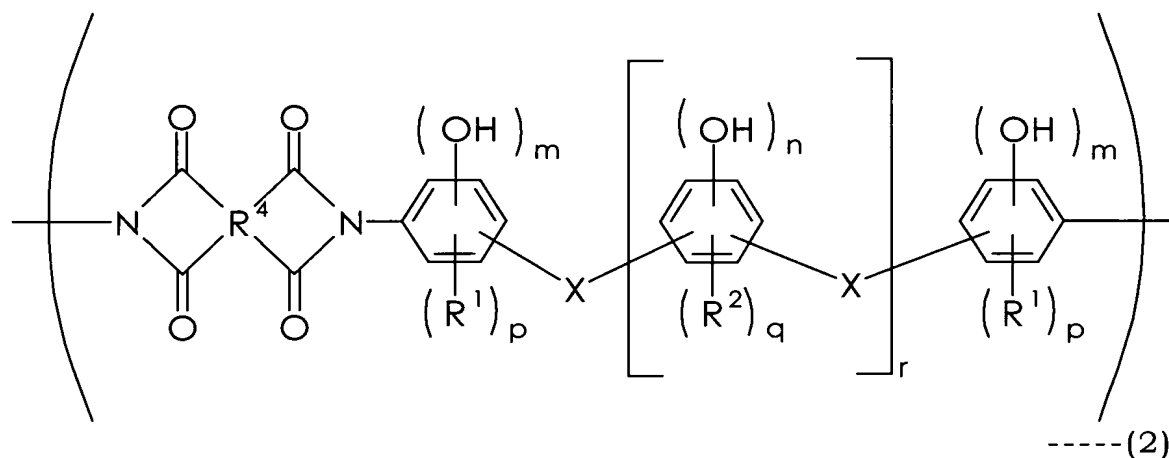


-----(1)

where  $\text{R}^1$  and  $\text{R}^2$  may be identical with or different from each  
other, and each of  $\text{R}^1$  and  $\text{R}^2$  represents a hydrogen atom, an  
alkyl group containing 1 to 9 carbon atoms, an alkoxy group  
containing 2 to 10 carbon atoms, or  $\text{COOR}^3$  ( $\text{R}^3$  represents a  
hydrogen atom or an alkyl group containing 1 to 9 carbon

atoms), and X represents -O-, -S-, -SO<sub>2</sub>-, -C(CH<sub>3</sub>)<sub>2</sub>-, -CH<sub>2</sub>-,  
 -C(CH<sub>3</sub>)(C<sub>2</sub>H<sub>5</sub>)-, or C(CF<sub>3</sub>)<sub>2</sub>-, and each of m and p is an integer  
 not less than 0 which is under such condition that m+p=4,  
 and each of n and q is an integer not less than 0 which is  
 under such condition that n+q=4, and r is any one of integers  
 0 to 10.

5. The photosensitive resin composition as set forth in  
 claim 2, wherein the polyimide resin (A-1) is a polyimide resin  
 having at least one recurring unit represented by formula (2)



where R<sup>1</sup> and R<sup>2</sup> may be identical with or different from each  
 other, and each of R<sup>1</sup> and R<sup>2</sup> represents a hydrogen atom, an  
 alkyl group containing 1 to 9 carbon atoms, an alkoxy group  
 containing 2 to 10 carbon atoms, or COOR<sup>3</sup> (R<sup>3</sup> represents a  
 hydrogen atom or an alkyl group containing 1 to 9 carbon  
 atoms), and X represents -O-, -S-, -SO<sub>2</sub>-, -C(CH<sub>3</sub>)<sub>2</sub>-, -CH<sub>2</sub>-,

-C(CH<sub>3</sub>)(C<sub>2</sub>H<sub>5</sub>)-, or C(CF<sub>3</sub>)<sub>2</sub>-, and R<sup>4</sup> represents a residue of aromatic tetra carboxylate dianhydride, and each of m and p is an integer not less than 0 which is under such condition that m+p=4, and n and q are under such condition that n+q=4, and n is an integer not less than 0 and q is an integer not less than 0, and r is any one of integers 0 to 3.

6. The photosensitive resin composition as set forth in claim 2, wherein a weight-average molecular weight of the polyimide resin (A-1) or the polyamide resin (A-2) is 5000 or more and 100000 or less.

7. The photosensitive resin composition as set forth in claim 2, wherein a hydroxyl equivalent of the polyimide resin (A-1) or the polyamide resin (A-2) is 5000 or less.

8. The photosensitive resin composition as set forth in claim 7, wherein the hydroxyl equivalent of the polyimide resin (A-1) or the polyamide resin (A-2) is 3000 or less.

9. The photosensitive resin composition as set forth in claim 2, wherein the (meth)acryls compound (B) is a compound having at least one epoxy group and at least one (meth)acryl group in its molecule.

10. The photosensitive resin composition as set forth in claim 2, wherein the (meth)acryls compound (B) is epoxy (meth)acrylate having at least two hydroxyl groups in its molecule.

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11. The photosensitive resin composition as set forth in claim 2, further comprising, as an accessory component (C), at least one kind selected from: at least one kind (C-1) of a photoreaction initiator, a sensitizer, and a photopolymerization assistant; a flame retardant (C-2); an epoxy resin (C-3); and a curing promotion agent and/or a curing agent (C-4).

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12. The photosensitive resin composition as set forth in claim 1, wherein:

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the base resin component is the polyimide resin (A-1), and the polyimide resin (A-1) is a photosensitive polyimide resin (A-1-2) obtained by reacting a compound having a carbon-carbon double bond with a polyimide resin having a hydroxyl group in its structure, and

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the (meth)acryls compound (B) is at least one kind of a compound selected from a (meth)acrylic compound, an epoxy (meth)acrylate, a polyester (meth)acrylate, a urethane (meth)acrylate, and an imide (meth)acrylate, and

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the photosensitive resin composition further includes, as

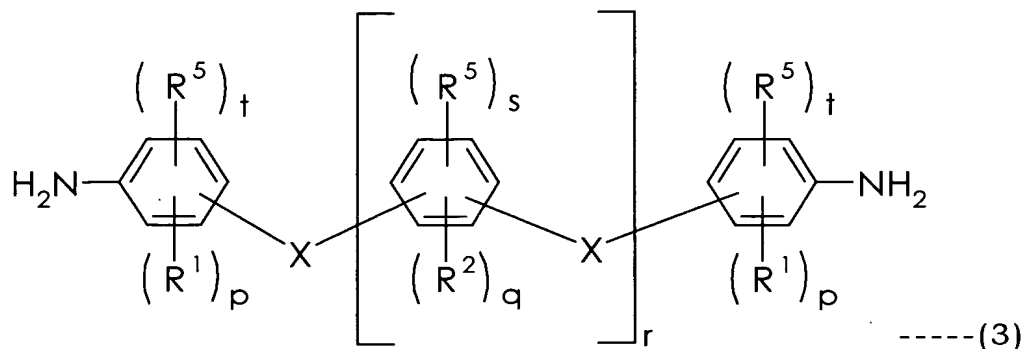
an accessory component (C), at least one kind (C-1) selected from a photoreaction initiator, a sensitizer, and a photopolymerization assistant.

5           13. The photosensitive resin composition as set forth in claim 12, wherein:

10           the photosensitive polyimide resin (A-1-2) is a polyimide resin having a phenolic hydroxyl group which is a polyimide resin partially made of a phenol derivative having an amino group, and

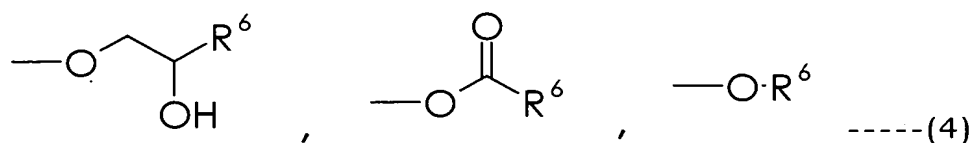
15           the phenol derivative is such that two or more phenol compounds bind each other via an atom or an atom group in a chain manner and each of the phenol compounds at both ends has an amino group which substitutes one of hydrogen atoms in a benzene ring.

14. The photosensitive resin composition as set forth in claim 13, wherein the phenol derivative used as a martial for the polyimide resin is a compound represented by formula (3)



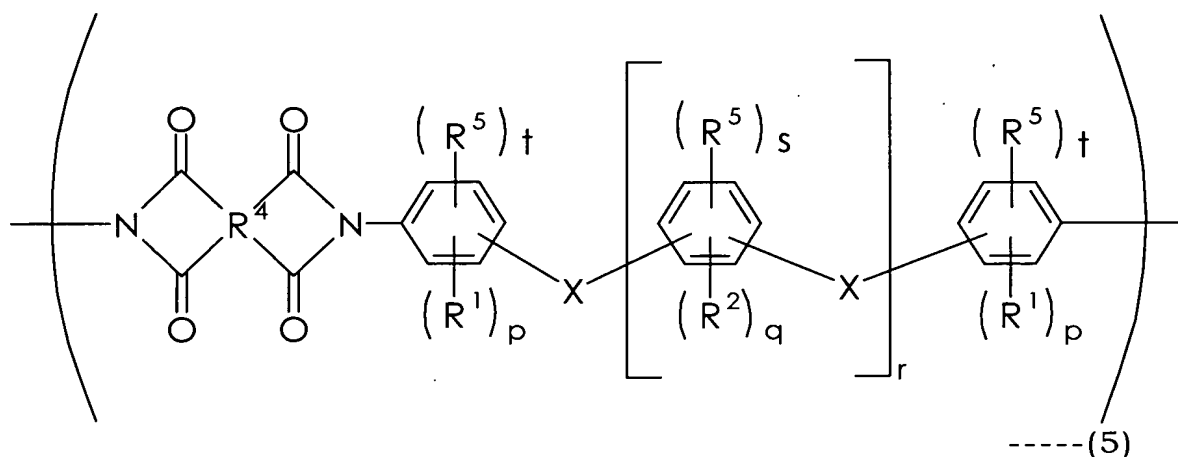
where  $R^1$  and  $R^2$  may be identical with or different from each other, and each of  $R^1$  and  $R^2$  represents a hydrogen atom, an alkyl group containing 1 to 9 carbon atoms, an alkoxy group containing 2 to 10 carbon, or  $COOR^3$  ( $R^3$  represents a hydrogen atom or an alkyl group containing 1 to 9 carbon atoms), and X represents  $-O-$ ,  $-S-$ ,  $-SO_2-$ ,  $-C(CH_3)_2-$ ,  $-CH_2-$ ,  $-C(CH_3)(C_2H_5)-$ , or  $C(CF_3)_2-$ , and all of  $R^5$  may be identical with or different from each other, and each  $R^5$  represents  $-OH$  or an unsaturated organic group having a carbon-carbon double bond in its structure, and each  $R^5$  includes both  $-OH$  and the unsaturated organic group, a number of  $-OH$  or the unsaturated organic group being at least one, and each of t and p is an integer not less than 0 which is under such condition that  $t+p=4$ , and each of s and q is an integer not less than 0 which is under such condition that  $s+q=4$ , and r is any one of integers 0 to 10.

15. The photosensitive resin composition as set forth in claim 14, wherein the unsaturated organic group is an organic group selected from a group (4)



where  $R^6$  is a monovalent organic group having a carbon-carbon double bond.

16. The photosensitive resin composition as set forth in claim 12, wherein the photosensitive polyimide resin (A-1-2) is a polyimide resin having at least one recurring unit represented by formula (5)

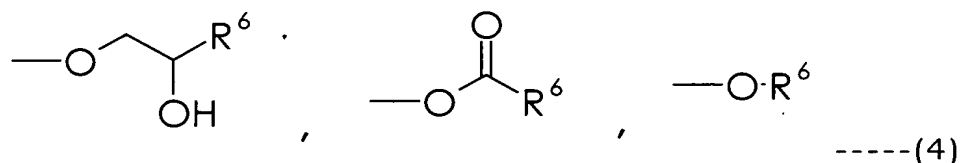


where  $R^1$  and  $R^2$  may be identical with or different from each other, and each of  $R^1$  and  $R^2$  represents a hydrogen atom, an alkyl group containing 1 to 9 carbon atoms, an alkoxy group containing 2 to 10 carbon atoms, or  $\text{COOR}^3$  ( $R^3$  represents a hydrogen atom or an alkyl group containing 1 to 9 carbon atoms), and X represents  $-\text{O}-$ ,  $-\text{S}-$ ,  $-\text{SO}_2-$ ,  $-\text{C}(\text{CH}_3)_2-$ ,  $-\text{CH}_2-$ ,  $-\text{C}(\text{CH}_3)(\text{C}_2\text{H}_5)-$ , or  $\text{C}(\text{CF}_3)_2-$ , and  $R^4$  represents a residue of aromatic tetra carboxylate dianhydride, and all of  $R^5$  may be identical with or different from each other, and each  $R^5$



represents -OH or an unsaturated organic group containing a carbon-carbon double bond in its structure, each  $R^5$  includes both -OH and the unsaturated organic group, a number of -OH or the unsaturated organic group being at least one, and each of t and p is an integer not less than 0 which is under such condition that  $t+p=4$ , and each of s and q is an integer not less than 0 which is under such condition that  $s+q=4$ , and r is any one of integers 0 to 10.

17. The photosensitive resin composition as set forth in claim 16, wherein the unsaturated organic group is an organic group selected from a group (4)



where  $R^6$  is a monovalent organic group having a carbon-carbon double bond.

18. The photosensitive resin composition as set forth in claim 12, wherein a weight-average molecular weight of the photosensitive polyimide resin (A-1-2) is 5000 or more and 200000 or less.

19. The photosensitive resin composition as set forth in

claim 13, wherein a weight-average molecular weight of each phenolic hydroxyl group of the polyimide resin is 10000 or less.

5           20. The photosensitive resin composition as set forth in claim 12, wherein the (meth)acryls compound (B) is a compound having at least one epoxy group and at least one (meth)acryl group in its molecule.

10           21. The photosensitive resin composition as set forth in claim 12, wherein the (meth)acryls compound (B) is epoxy (meth)acrylate having at least two hydroxyl groups in its molecule.

15           22. The photosensitive resin composition as set forth in claim 12, further comprising, as the accessory component (C), at least one kind selected from: a flame retardant (C-2); an epoxy resin (C-3); and a curing promotion agent and/or a curing agent (C-4).

20           23. The photosensitive resin composition as set forth in claim 2, wherein:

          the base resin component is the polyimide resin (A-1), and the polyimide resin (A-1) is a soluble polyimide resin (A-1-3) having a polymerizable functional group and at least

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one of a carboxyl group and a hydroxyl group, and

the photosensitive resin composition further includes, as  
a storage stabilization additive (D), at least one kind selected  
from a polymerization inhibitor, a stabilizer, and an  
5 oxidization inhibitor.

24. The photosensitive resin composition as set forth in  
claim 23, wherein the soluble polyimide resin (A-1-3) includes,  
as a polymerizable functional group, at least one kind of a  
10 functional group selected from a vinyl group and a  
(meth)acryl group.

25. The photosensitive resin composition as set forth in  
claim 23, wherein the storage stabilization additive (D) is at  
15 least one kind of a compound selected from a hydroquinone  
compound, a hindered phenolic compound, a nitrosamine  
compound, and an aromatic amine.

26. The photosensitive resin composition as set forth in  
20 claim 23, wherein a viscosity increasing rate in case where  
the photosensitive resin composition is left at a room  
temperature for 7 days under such condition that the  
photosensitive resin composition is dissolved in an organic  
solvent is 0% or more and 20% or less.

27. The photosensitive resin composition as set forth in claim 23, further comprising, as the accessory component (C), at least one kind selected from: at least one kind (C-1) of a photoreaction initiator, a sensitizer, and a photopolymerization assistant; a flame retardant (C-2); an epoxy resin (C-3); and a curing promotion agent and/or a curing agent (C-4).

28. The photosensitive resin composition as set forth in claim 2, wherein:

the base resin component is the photosensitive imide (meth)acrylsiloxaneoligomer (A-3), and

the (meth)acryls compound is a polyunsaturated (meth)acryls compound (B-1) having two or more unsaturated double bonds, and

an amount of the polyunsaturated (meth)acryls compound (B-1) ranges from 5 to 200 parts by weight with respect to 100 parts by weight of the photosensitive imide (meth)acrylsiloxaneoligomer (A-3).

29. The photosensitive resin composition as set forth in claim 28, wherein:

the photosensitive imide (meth)acrylsiloxaneoligomer (A-3) is obtained by reacting imidesiloxaneoligomer with an epoxy compound having a double bond, and

the imidesiloxaneoligomer is obtained by reacting diamine with tetra carboxylate dianhydride and imidizing the diamine and the tetra carboxylate dianhydride that have been reacted.

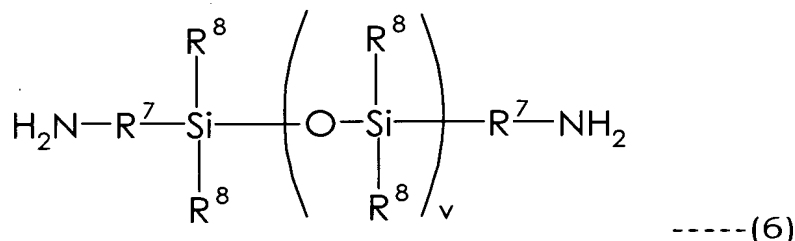
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30. The photosensitive resin composition as set forth in claim 29, wherein the diamine is at least siloxanediamine.

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31. The photosensitive resin composition as set forth in claim 30, wherein the siloxanediamine is diaminopolysiloxane represented by formula (6)

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where  $\text{R}^7$  is  $-\text{C}_u\text{H}_{2u}-$  or  $-\text{C}_6\text{H}_4-$ , and  $\text{R}^8$  is a methyl group, an ethyl group, or a phenyl group, and  $u$  is any one of integers 1 to 6, and  $v$  is any one of integers 2 to 50.

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32. The photosensitive resin composition as set forth in claim 31, wherein: in case of using the diaminopolysiloxane as the diamine, a molar ratio of the diaminopolysiloxane ranges from 5 to 70mol% with respect to 100mol% of whole

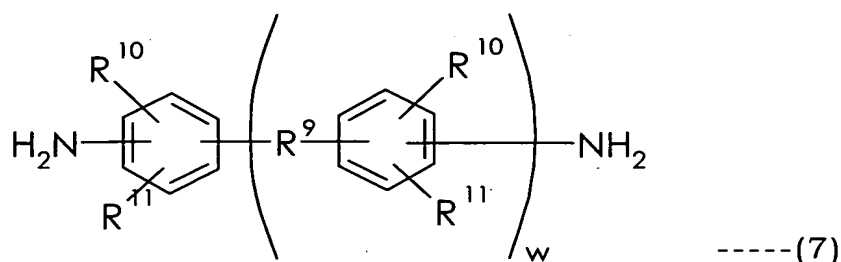
the diamine.

33. The photosensitive resin composition as set forth in claim 29, wherein diamine having a phenolic hydroxyl group or diamine having a carboxyl group is used as the diamine.

34. The photosensitive resin composition as set forth in claim 33, wherein: in case of using the diamine having a phenolic hydroxyl group as the diamine, a molar ratio of the tetra carboxylate dianhydride ranges from 50 to 95mol% with respect to 100mol% of whole the diamine.

35. The photosensitive resin composition as set forth in claim 33, wherein: in case of using the diamine having a carboxyl group as the diamine, a molar ratio of the diamine ranges from 50 to 95mol% with respect to 100mol% of the tetra carboxylate dianhydride.

36. The photosensitive resin composition as set forth in claim 33, wherein the diamine having a phenolic hydroxyl group or the diamine having a carboxyl group is an aromatic diamine compound represented by formula (7)



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where  $\text{R}^9$  represents a group having a direct bond or a bivalent group selected from  $-\text{O}-$ ,  $-\text{S}-$ ,  $-\text{CO}-$ ,  $-\text{SO}_2-$ ,  $-\text{SO}-$ ,  $-\text{CH}_2-$ ,  $-\text{C}(\text{CH}_3)_2-$ ,  $-\text{O}-\text{C}_6\text{H}_4-\text{O}-$ ,  $-\text{C}_6\text{H}_4-$ , and  $-\text{O}-\text{C}_6\text{H}_4-\text{C}(\text{CH}_3)_2-\text{C}_6\text{H}_4-\text{O}-$ , and  $\text{R}^{10}$  represents  $-\text{OH}$  or  $-\text{COOH}$ , and  $\text{R}^{11}$  represents a hydrogen atom, a methyl group, or a halogen atom.

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37. The photosensitive resin composition as set forth in claim 28, further comprising a flame retardant (C-2) as the accessory component (C).

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38. The photosensitive resin composition as set forth in claim 37, wherein an amount of the flame retardant (C-2) ranges from 5 to 200 parts by weight with respect to 100 parts by weight of the photosensitive imide (meth)acrylsiloxaneoligomer (A-3) and 5 to 200 parts by weight of the polyunsaturated (meth)acryls compound (B-1).

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39. The photosensitive resin composition as set forth in claim 37, wherein the flame retardant (C-2) is at least one

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kind of a compound selected from phosphate ester, condensed phosphate ester, phosphite ester, phosphagene compound, phosphine oxide, phosphine, phosphate ester having halogen atom, condensed phosphate ester having halogen atom, (meth)acryls compound having halogen atom, and organopolysiloxane compound.

40. The photosensitive resin composition as set forth in claim 28, further comprising: at least one kind (C-1) selected from a photoreaction initiator, a sensitizer, and a photopolymerization assistant; an epoxy resin (C-3); and at least one kind (C-4) selected from a curing promotion agent and/or a curing agent.

41. A photosensitive dry film resist, being made of the photosensitive resin composition as set forth in any one of claims 1 to 40.

42. The photosensitive dry film resist as set forth in claim 41, wherein an epoxy resin layer is formed on a surface of the photosensitive dry film resist.

43. The photosensitive dry film resist as set forth in claim 41, wherein: in case of using, as a developer, 1 wt% of sodium hydrate whose temperature is 40°C and using a spray



developing device as developing means,

a dissolving time at a spray pressure of 0.85MPa is 180 seconds or less.

5           44. The photosensitive dry film resist as set forth in claim 43, wherein the dissolving time is 20 seconds or more.

10           45. The photosensitive dry film resist as set forth in claim 41, wherein: in case of using, as a developer, a sodium hydrate aqueous solution whose temperature is 40°C and whose concentration is 1 wt% and using a spray developing device as developing means,

15           a dissolving time at a spray pressure of 0.85MPa varies within a range of  $\pm 20\%$  after the photosensitive dry film resist is left at room temperature for 7 days compared with the photosensitive dry film resist before being left for 7 days.

20           46. A laminate, including a layer made of the photosensitive dry film resist as set forth in any one of claims 41 to 45,

said laminate comprising at least either a protective film for protecting the surface of the photosensitive dry film resist or a support film for supporting the photosensitive dry film resist.

47. A print wiring substrate, using the photosensitive dry film resist as set forth in any one of claims 41 to 45 as an insulating protection layer.

5           48. A flexible print wiring substrate, using the photosensitive dry film resist as set forth in any one of claims 41 to 45 as a photosensitive cover lay film.

10           49. A flexible print wiring substrate, comprising a photosensitive cover lay film made of the photosensitive resin composition as set forth in any one of claims 1 to 40.